

Patterns of Food Preferences Through Factor Analysis

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The fact that preferences for different foods are correlated suggests the existence of underlying psychological dimensions.

Studies of soldiers' food preferences revealed certain basic dimensions of food preference. Some factors consisted of a generalized liking for certain conventional food classes such as fruits or desserts, but other preference factors tended to cut across food classes or were only a small part of a class.

WHAT one eats is presumably a function of environment or learning, physiological effects, and immediate sensation.¹ Is a person's food choice determined mainly by the individual food or by some characteristic which may be common to several foods? The latter would appear to be the case, on the basis

¹Francis J. Pilgrim, "The Components of Food Acceptance and Their Measurement." *American Journal of Clinical Nutrition*, Vol. 5 (March-April, 1957), pp. 171-175.

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This article reports research (Publication No. 842) undertaken at the Quartermaster Food and Container Institute for the Armed Forces. The views or conclusions are those of the authors, and are not to be construed as necessarily reflecting the views or endorsement of the Department of Defense.

of intuition and of concrete evidence from food-preference surveys.

Between 1950 and 1954 a series of surveys of food preferences were conducted among Army personnel. Questionnaires were used to obtain information on more than 400 foods, and on certain background characteristics of the respondents such as age and region of origin.

It was found that whole classes of food varied with one or more background factors. For example, desserts were more preferred by younger men, while vegetables and soups increased in preference with age of respondent. But it was not found out whether there were also patterns to an individual's preferences not directly related to the background characteristics measured. To obtain further information, factor analysis was selected as a tool.

Factor analysis is a method for examining the correlations existing among variables—in this case, preference ratings for different foods—to determine whether these variables can be adequately accounted for by a much smaller number of statistically independent categories.

METHOD

Questionnaire and Respondent Sample

Each questionnaire had: (a) a list of

fifty-four food names, each interposed between a rating scale and a "not-tried" category, and (b) a page of questions on background characteristics of the respondent. Surveys were limited to fifty-four foods because respondents are not able to deal with over sixty foods in one survey. Preferences were obtained with a g-category like-dislike rating scale.² The successive categories were scored from 1 to 9, beginning at the dislike end.

A stratified, systematic sample of approximately 2,000 was drawn from all non-commissioned Army personnel in the United States for each survey. The two surveys used for the factor analyses were conducted in February and October, 1951. These two surveys were selected from the series because they asked about a variety of foods and also they had in common six identical or similar foods.

Factor Analyses and Interpretation

From the total sample of respondents in each survey a random sample of 200 was drawn. For any given food, some respondents gave no rating, but instead indicated they had "not tried" the food. To simplify computations, the mean rating derived from those who did rate that food was substituted for an endorsement of "not tried." An index of the total number of foods not tried by each individual was used as another variable and represented the narrowness of food experiences.

Data on age, length of Army service, education, and size of town of upbringing also were used. These four variables had five to eight class intervals. For each survey the fifty-nine variables—fifty-four foods, four background variables, and the "not-tried" measure—were intercorrelated. A factor analysis method was then used to extract ten factors affecting these variables.³

Six psychologists working on food-acceptance problems and one nutritionist independently interpreted the factors. To clarify and unify the results, the in-

terpretations then were discussed in a group.

RESULTS

Interpretations were based on three types of evidence. First were the foods themselves, where there was an obvious relationship among them. Second was a general knowledge of people's food behavior. Third was the information derived from other non-factor analytical analyses of the series of eight surveys conducted.

In addition to analyses of variation in preference for a number of foods in relation to the background data that were used in the factor analyses, there were analyses based on geographical origin. In these analyses the continental United States was divided into ten regions. The factor analyses showed clusters of foods preferred in the South. Surveys which included other foods may be expected to have clusters typical of some of the other regions of rearing.

Although some inconsistencies occurred, the six identical or similar foods included in both surveys were represented by the same or similar factors, when the two analyses produced similar factors. This correspondence is important in terms of the reliability of the factors.

In neither analysis was the variation of the five nonfood variables appreciably accounted for by any of the factors, although their magnitude and direction to some extent corresponded with knowledge gained from the analyses of background data mentioned previously.

SIGNIFICANCE OF RESULTS

Where possible, each factor was named for a common food class or food characteristic. In addition, a secondary name or description was given as an elaboration or explanation. In many cases there were

² David R. Peryam and Francis J. Pilgrim, "Hedonic Scale Method of Measuring Food Preferences," *Food Technology*, Vol. 11, Supplement (September, 1957), pp. 9-14.

³ Factors were extracted by the centroid approach and then rotated by the quartimax method. See Benjamin Fruchter, *Introduction to Factor Analysis* (New York: Van Nostrand, 1954); Jack O. Neuhaus and Charles Wrigley, "The Quartimax Method: An Analytic Approach to Orthogonal Simple Structure," *British Journal of Statistical Psychology*, Vol. 7 (November, 1954), pp. 81-91.

TABLE I
FACTORS FROM TWO FOOD PREFERENCE SURVEYS INTERPRETED
IN TERMS OF FOODS AND OF PEOPLE

First Survey			Second Survey		
Sum of squares of factor loadings ^a	In terms of foods	In terms of people	Sum of squares of factor loadings ^a	In terms of foods	In terms of people
3.0	MEAT-SOLID Main dish	MASCULINE	1.6	MEAT-SOLID General	BEEF-EATER
2.5	SWEET Desserts	CHILDREN Treats	5.7	SWEET Desserts	YOUTH Quick energy
2.0	FRUIT	HEALTHFUL	1.9	FRUIT	YOUTH
1.9	STRONG FLAVORS Root vegetables Cold vegetables	URBAN	1.6	STRONG FLAVORS Vegetables Specialties	SOUTH
2.2	STARCH Mixed dishes	YOUTH	1.1	STARCH Main dish	COMMON FOODS ONLY
2.3	CASSEROLE Creamed	ECONOMICAL Tea room	1.5	SOFT Creamy Specialties	TEA ROOM
2.0	SOFT Starch	COMMON FOODS ONLY	1.7	MIXED MEAT Main dish	ECONOMICAL Quick lunch
2.3	LIGHT MAIN DISH Soups	LUNCHEON	3.4	FISH	SOUTH Small town
1.8	HOT BREAD Pork	SOUTH	1.7	Low preference SWEET BREAD Breakfast	
1.2	SNACKS	PICNIC Buffet	1.6	ACCESSORIES Tart	LOW CALORIE

^a Represented the amount of variation out of a total of 59 (the number of original variables) accounted for by a factor; thus, the first factor of the first survey accounted for 3/59 or 5 per cent of the variation in the preference ratings and background measures.

other foods in a factor that either contributed to or extended the interpretation.

For example, in both analyses a "sweet" factor emerged. The high correlations between factors and food items (the "factor loadings") were mainly for desserts, but also for other sweet items such as cereals that are usually eaten with sugar. However, there were other foods, such as bologna and frankfurters, that are not sweet but which belong with sweets for a class of people, youths or children. Preferences for all these foods were negatively correlated with age and with length of time spent in the Army. Thus, in terms of food classes, the factor was mainly "sweet," but in terms of people it was not just "sweet-tooth" but "youth."

Perhaps more important is the fact that, with two different lists of foods and two different samples of respondents, a number of the same or similar factors were revealed. This statement is not based on the interpretations only, but on the results from the foods common to the two surveys. Although correspondence was not perfect, it was sufficiently good to indicate the reality and meaningfulness of the factors obtained from the analyses.

The total sums of squares for each factor are shown in Table 1. These add up to approximately 21 in each case, representing about 36 per cent of the total variance of 59 (the number of variables) in the original correlation matrixes. Much of the variation remains unaccounted for, partially because some of the preferences for individual foods are unrelated to a food class or characteristic. In addition, information represented by the response "not tried" is lost when the mean rating of the food is substituted for it.

The variability and individuality of people's behavior toward food is well known. Nevertheless, expectations that there are patterns of likes and dislikes is supported by this study. But these patterns are neither simple nor few in number.

The nature of the factors suggests that some arise from sensations from the foods, and some from cultural or environmental

determinants. A factor such as sweet could result from either of these; but there is good reason to believe that physiological or metabolic requirements dictate in part the higher preference and demand for sugar in the earlier years of life.

Another study has shown that preference for classes of foods—such as meats, potatoes, vegetables, and salads—is related significantly, although to a small degree, to personality as measured by the Thurstone Temperament Schedule.⁴

The factor analyses in the present study also presented new ways of looking at the interrelationships among food attitudes beyond the conventional classifications of foods as meats, vegetables, and other major components of a meal. Thus, the assertion that people can be divided into meat "partisans" and "antagonists" may be an over-simplification because the partisanship may encompass only solid meats, mixed meats, or creamed meats.

In other cases a factor may cut across conventional classes, for example, youth foods. Note that the analyses provided no evidence for the existence of general food "lovers" or food "haters." Rather, there seemed to be different "chow-hound" types, each of whose interests in foods was more restricted than is commonly assumed.

This conclusion points to the possibilities of being too specific in promotional campaigns. For example, an advertiser in showing how his food can be prepared may emphasize creamy preparations. Unless he is intentionally aiming toward a limited audience, he might sacrifice a large number of people potentially favorably disposed to his product by not presenting in his appeal preparations representative of several independent factors. If he does intend to appeal to a limited audience, the factor analyses provide hints on what foods from different classes are suitable for "tie-in" promotions.

⁴Howard G. Schutz and Joe Kamenetzky, "Temperament Correlates of Food Preference and Rejection," presented at the 29th annual meeting of the Midwestern Psychological Association, Chicago, May 3, 1957.